

1 572 849

- (21) Application No. 13135/77 (22) Filed 29 March 1977  
 (31) Convention Application No. 2 613 447  
 (32) Filed 30 March 1976 in  
 (33) Fed. Rep. of Germany (DE)  
 (44) Complete Specification published 6 Aug. 1980  
 (51) INT CL<sup>3</sup> F16J 15/52  
 (52) Index at acceptance F2B 13C3  
 (72) Inventors FRIEDRICH GROSS, PETER BINDER and DIETER BREHMER



## (54) EXPANDABLE SEALING GAITER

(71) We, WABCO FAHRZEUG-BREMEN G.M.B.H., formerly Wabco Westinghouse G.m.b.H., a Company organised according to the laws of the Federal Republic of Germany, of 3000 Hannover 91, Postfach 91 12 80, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an expandable gaiter suitable for sealing a piston rod of a working cylinder, for example, of a diaphragm cylinder for a pneumatic brake system of a vehicle. The piston rod may be connected at one end to a diaphragm piston and may have at its other end a forked head, the expandable gaiter being secured around a holding device on the cylinder.

Expandable gaiters of the above type are intended to seal water, dirt and other contamination from the aperture in the end face of the cylinder through which aperture the piston rod passes. In a diaphragm cylinder the aperture is of necessity relatively large because a certain amount of angular movement may be required of the piston rod, so that contaminants could enter the cylinder relatively easily were the aperture not sealed.

Expandable gaiters are known which have an annular reinforcement at each end, by means of which they can be clamped at one end to a holding device on the diaphragm cylinder and at the other can be drawn over the end of the piston rod, and can be fastened to it, for example, by means of a clip. A disadvantage of this arrangement is that if the piston rod has a forked head, then for purposes of placing the expandable gaiter in position either the forked head has to be detached from the piston rod or the expandable gaiter has to be split to allow it to pass over the head and as a result no longer provides a seal. A further disadvantage is that if the piston rod is provided with a forked head which is firmly fixed so that it cannot be detached, the aperture in the end face of the

diaphragm cylinder through which the piston rod passes may be square with the result that difficulty may be encountered in securing the gaiter round it.

It is an object of the invention to provide an expandable gaiter in which the above disadvantages are at least partly avoided.

According to the invention there is provided an expandable gaiter of resilient material for a piston rod having a forked head, the gaiter having a corrugated expandable region extending between a first end having a ring large enough to pass over the forked head and shaped to fit a holding device and a second end having an end face reinforced in its central area in which are formed at least two openings shaped to fit on to respective legs of the forked head.

Advantages which may be obtained with an expandable gaiter according to examples of this invention are, in particular, that the sealing lip, which is arranged along the outer edge of the annular reinforcement that can be fitted on to the holding device on the end face of the diaphragm cylinder so that the lip is pressed resiliently against the end face of the diaphragm cylinder by its inner edge, effectively seals the opening made in the end face of the diaphragm cylinder, through which the piston rod passes, which opening may be square to accommodate the shape of the forked head. The sealing lip can be arranged to remain in its resilient sealing position on the end face of the cylinder even when the piston rod is inclined at a large angle to the axis of the cylinder and thereby prevent the penetration of dirt, splashes of water and other similar contamination into the diaphragm cylinder. Further, the end of the expandable gaiter which is provided with separate openings fitting the legs of the forked head, is very easy to assemble on the head simply by pulling it on; this means that the head can be welded to the piston rod, which is cheaper than a detachable mounting. As a result, compared with fixing of the gaiter to the piston rod below the portion of the female thread of the forked end, more length is available

for the expandable gaiter, which means that the piston rod can be shorter for the same piston stroke, which may be of advantage as regards vehicle construction.

5 Sealing lips may also be formed along the edges of the openings in the end face of the expandable gaiter through which the legs of the forked head project, and would result in an improved and secure seal on the legs of the forked head. Tapered lip portions curved  
10 towards the centre of the end face may be provided on the outside edges of the openings to ensure close contact with the outer sides of the legs of the forked head, even at the  
15 maximum piston stroke.

In order that the invention may be fully understood and readily carried into effect an embodiment of the invention will now be described with reference to the accompanying drawings, of which:

20 Figure 1 shows a longitudinal section through an expandable gaiter according to an example of the invention in place on a diaphragm cylinder; and

25 Figure 2 shows a plan view of the gaiter of Figure 1 with the aperture in the end face of the diaphragm cylinder shown by a dotted line.

30 The expandable gaiter 1 of resilient material which is illustrated in Figure 1, has at one end an annular reinforcement 2 by which it engages a holding device 5 inserted in an aperture 3 in an end face of a diaphragm cylinder. At its other end the gaiter 1 has an  
35 end face 6 having openings 7, 7' made therein through which project legs 8, 8' of a forked head 10 fixed onto a piston rod 9.

The annular reinforcement 2 has along its outer edge at the end face of the gaiter 1 a  
40 sealing lip 11, which extends continuously more or less along the axis of the gaiter 1, and is of inwardly tapering cross-section. The lip 11, when the annular reinforcement 2 engages the holding device 5, lies resiliently  
45 with its inner edge against the end face 4 of the diaphragm cylinder. As shown in Figure 2, the gaiter 1 effectively covers and seals the aperture 3 in the end face 4 of the diaphragm cylinder through which the piston rod 9 passes.  
50 The aperture 3 is circular with four recesses 12 provided to make it more square and correspond to the cross-section of the forked head 10, because during assembly it is necessary for the forked head 10, which is firmly connected to the piston rod 9, to pass through the  
55 aperture 3.

The end face 6 of the gaiter 1 is reinforced in its central area, and the openings 7, 7' which are made in the reinforced central area, correspond in shape and size to the cross-section of the legs 8, 8' of the forked head 10.

60 Along the outer edges of the openings 7, 7', continuous lips 13, 13' are formed to lie closely against the legs 8, 8' of the forked head 10. As can be seen from Figure 2, the

lips 13, 13' have portions 14, 14' which are curved towards the centre of the end face 6, in the outer parts of the edges round the opening 7, 7'. The portions 14, 14' are, as Figure 1 shows, tapered inwardly.

The expandable gaiter 1 formed and mounted in the manner described above can be extended from a starting position as shown in the Figure 1, the extension taking place in its compressed folded region, which continues up to the legs 8, 8' of the forked head 10.

At the maximum piston stroke, the expandable gaiter 1 is extended in its folded area, but, in so doing, its seal remains unbroken both at the forked head 10, with the sealing lips 13, 13' and their curved portions 14, 14' lying against the legs 8, 8'; and also at the end face 4 of the diaphragm cylinder with the sealing lip 11. It will be appreciated that the gaiter 1 as a result of its construction including sealing lips lying resiliently against the surfaces provides an effective seal over the aperture 3 to prevent the ingress of contaminants.

Although the invention has been described with reference to a specific embodiment it will be understood that it is not limited to that embodiment, and modifications to the shape of the gaiter can be made to fit differing shapes of aperture in the cylinder end face and other forms of attachment head on the piston rod. Gaiters according to the invention are not limited in their application to diaphragm cylinders, but can be used with piston and cylinder arrangements of other types, clutch and brake mechanism and for gear-change mechanisms, for example.

#### WHAT WE CLAIM IS:—

1. An expandable gaiter of resilient material for a piston rod having a forked head, the gaiter having a corrugated expandable region extending between a first end having a ring large enough to pass over the forked head and shaped to fit a holding device and a second end having an end face reinforced in its central area in which are formed at least two openings shaped to fit on to respective legs of the forked head.

2. A gaiter according to claim 1 wherein the ring is arranged to be stretched over and contract into the holding device, and a sealing lip is formed on the outside of the ring so as to be pressed on to a surface when the ring is fitted into the holding device.

3. A gaiter according to claim 1 or 2 wherein two openings are formed in the reinforced central area of the end face at the second end.

4. A gaiter according to claim 1, 2 or 3 wherein the openings formed in the reinforced central area of the end face have along their outer edges continuous sealing lips which would lie resiliently against legs of a forked head

when inserted in the openings.

5 5. A gaiter according to claim 4 wherein each of the sealing lips formed round the openings in the reinforced central area of the end face has a portion curved towards the centre of the end face.

6. A gaiter according to any preceding claim wherein the or each sealing lip is inwardly tapering.

7. An expandable gaiter substantially as described herein with reference to the accompanying drawings. 10

ABEL & IMRAY,  
Chartered Patent Agents,  
Northumberland House,  
303—306 High Holborn,  
London, WC1V 7LH.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1980.  
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from  
which copies may be obtained.

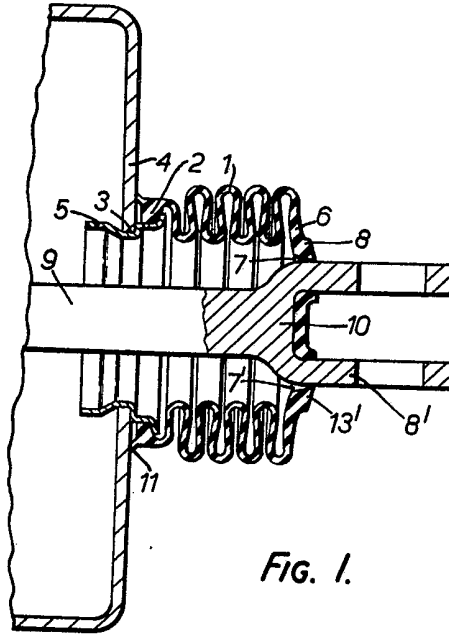


FIG. 1.

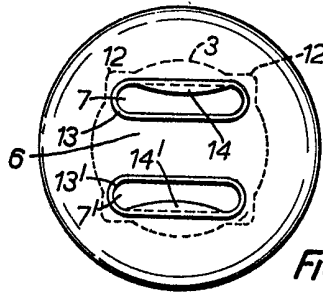


FIG. 2.